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(71) Applicant (for all designated States except US): WIRE-  
LESSCAR SWEDEN AB [SE/SE]; Stjärngatan 10, S-417  
55 Göteborg (SE).

(72) Inventor; and

(75) Inventor/Applicant (for US only): YNGVE, Lars-Mag-  
nus [SE/SE]; Stjärngatan 10, S-417 55 Göteborg (SE).

(74) Agents: ANDERSSON, Per et al.; Albiöns Göteborg AB,  
Box 142, S-401 22 Göteborg (SE).

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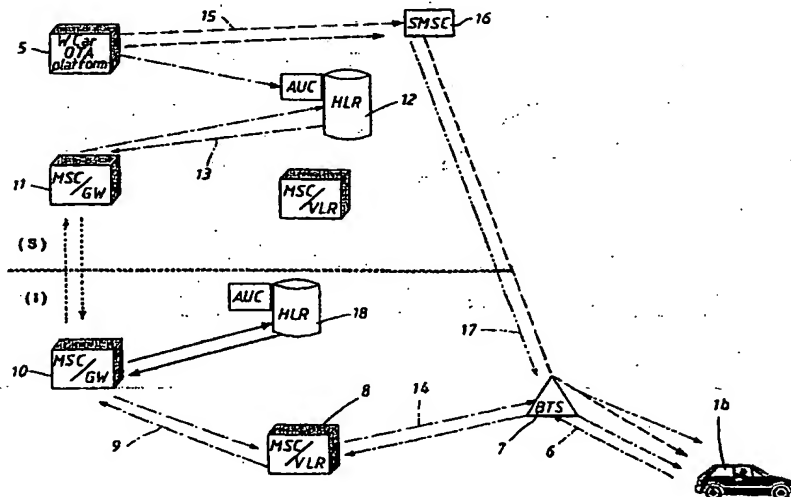
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(54) Title: METHOD AND SYSTEM FOR UPDATING AN ISDN NUMBER AND AN IDENTITY CODE IN A CELLULAR  
DIGITAL MOBILE TELEPHONE SYSTEM



(57) Abstract: The present invention relates to a method of updating a first identity code and a first ISDN number in a cellular digital mobile telephone system including at least some mobile transceivers fitted with fixed SIMs having recorded thereon a first identity code and a first ISDN number relating to an initial mobile telephone operator. The invention is characterized by delivering a second identity code relating to at least an additional mobile telephone operator over an air interface to said given SIM and connecting the second identity code to a second ISDN number at the same time as the first identity code is deactivated, such that no more than one identity code and ISDN number are active on said SIM at any given time. By means of the invention, an improved and more effective process for manufacturing vehicles can be accomplished.

WO 01/76309 A1

**METHOD AND SYSTEM FOR UPDATING A ISDN NUMBER AND A  
IDENTITY CODE IN A CELLULAR DIGITAL MOBILE TELEPHONE SYSTEM**

**TECHNICAL FIELD:**

- 5 The present invention relates to a method of updating data on a mobile phone's SIM, a mobile telephony system for implementing the method, and a SIM adapted to facilitate operation of the method.

**BACKGROUND OF THE INVENTION:**

- 10 In today's vehicles, at least one computerized control unit is normally used for controlling various functions and components in a vehicle. For example, such functions may include the fuel injection and ignition timing of the vehicle's engine. Such a control unit is mounted in the vehicle during final assembly of the vehicle.

- 15 Furthermore, it is common in today's vehicles to implement in such a control unit various functions related to mobile radio communication. In this manner, the control unit can be adapted for mobile telephony and on-board navigation and similar functions.

- 20 Such mobile radio communication functions can furthermore be implemented by arranging a suitable mobile radio communication apparatus in the vehicle. For this reason, a fixed mobile terminal can be mounted in the vehicle during final assembly of the vehicle. In order to allow mobile radio communication, a
- 25 so-called SIM (Subscriber Identity Module) must also be arranged in the above-mentioned control unit. The SIM is a smart card which comprises information such as for example its International Mobile Subscriber Identity (IMSI). The fact that the SIM is intended to be fixed in the vehicle means that during normal operation, the SIM is never intended to be removed from the
- 30 vehicle during the lifetime of the vehicle.

When a mobile radio communication apparatus, such as a mobile phone or other types of mobile terminals which includes a fixed SIM, is installed in a motor car, at the time of manufacture, the final destination of the car and the mobile phone are usually unknown. This means that the mobile network with which the mobile phone will operate, in normal use at its final destination, is unknown. Furthermore, "open" SIMs (i.e. SIMs which are activated and thus are associated with a subscription provided by a network operator) are not acceptable to the vehicle industry for, inter alia, security reasons.

Thus, the SIM installed in the mobile terminal may well contain data which is inappropriate to the final country of delivery for the car. With the GSM cellular mobile telephony system, it would, of course, be possible to operate the mobile phone via the mobile network in the country of origin of the car, by means of the GSM roaming facility. This will, however, generate an unacceptable signalling load on mobile telecommunications systems.

This problem could in principle be solved by modifying subscription information contained in the SIM. Various techniques for modifying subscription information contained on a mobile phone SIM, or operating multiple subscriptions are known.

Japanese patent applications JP 01-300 723 and JP 03-179 936 relate to setting telephone numbers to corresponding service areas by storing a plurality of telephone numbers.

PCT patent application WO 99/85105 discloses a dual SIM mobile car phone and is directed to a method of ensuring that the permanent SIM is updated on a regular basis with new information.

PCT patent application WO 98/56201 discloses a method of changing the subscription data on a mobile phone SIM. A message is received and date is changed when a mobile station is switched on for the first time with the SIM

connected to it. Upon receipt of the message, an acknowledgement of receipt of the message is sent. Based on the acknowledgement, the mobile communication system removes the first subscription from the data communication system and from the home location register. The  
5 acknowledgement is only sent after the SIM has processed the message, thus making sure that the data in the SIM has been changed.

Consequently, it can be noted that a problem arises in the case where a SIM is permanently mounted in a vehicle and the vehicle is shipped to a final  
10 destination country which is not known at the time of manufacturing of the vehicle. It can also be noted that the above-mentioned, previously known systems are not adapted for solving this problem in a simple and effective manner.

#### 15 SUMMARY OF THE INVENTION:

The object of the invention is to provide an improved method of updating data on the SIM being associated with a mobile radio communication terminal, in particular intended for use in the case in which a SIM is mounted in a fixed  
manner in a vehicle during manufacturing thereof.

20 This object is accomplished by means of a method according to subsequent claim 1.

According to a first aspect of the present invention, there is provided, in a  
25 cellular digital mobile telephone system, including at least some mobile transceivers fitted with fixed SIMs having recorded thereon a first identity code and a first ISDN number relating to a first mobile phone operator, a method of updating said first identity code and said first ISDN number, characterised by delivering a second identity code relating to a second  
30 operator over an air interface to said given SIM and connecting the second identity code to a second ISDN number at the same time as the first identity

code is deactivated, such that no more than one identity code and ISDN number are active on said SIM and any given time.

Preferably said cellular mobile telephone system is a GSM network.

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Preferably said first and second identity codes are IMSIs and said first and second ISDNs are MSISDNs.

10 According to a second aspect of the present invention, there is provided, in a GSM cellular digital mobile telephone system, including at least some mobile transceivers fitted with fixed SIMs having recorded thereon a first IMSI and a first MSISDN relating to a first mobile phone operator, a method of updating said first IMSI code and said first MSISDN, characterised by delivering a second IMSI relating to a second operator over an air interface to said given  
15 SIM and connecting the second IMSI to a second MSISDN at the same time as the first IMSI is deactivated, such that no more than one IMSI and MSISDN are active on said given SIM and any given time.

20 Said mobile transceivers may be fitted in motor vehicles and said first IMSIs and MSISDNs may be loaded on to said SIMs prior to installation of said mobile transceivers in said motor vehicle. Said first and second operators may be located in different countries or different geographic regions.

25 According to a third aspect of the present invention, there is provided a digital mobile cellular telephone system characterised in that said digital mobile cellular telephone system is adapted to implement a method as set forth in any previous paragraph.

30 According to fourth aspect of the present invention, there is provided a SIM for use in a mobile transceiver, characterised in that said SIM is adapted to implement a method as set forth in any previous paragraph.

The present invention overcomes these problems by activating the SIM when the car reaches its final destination with an OTA signal. The mobile telecommunications industry operates internationally, so the appropriate mobile network operator could be any one of a large number of companies.

- 5 As stated above, it is not economic to have a large number of roaming mobiles in each home country because of the excessive signalling that would be generated.

None of the above-mentioned previously known documents discloses a  
10 procedure in which:

- an IMSI number is held in a SIM, at the time a mobile telephone to which the SIM is fitted is installed in a car, and an MSISDN relating to an operator in the country of manufacture of the car is held on the SIM;  
15
- when the car is delivered, a new IMSI number, relating to a local operator, is delivered OTA to the SIM;
- the new IMSI is connected to a new MSISDN at the same time as the  
20 old IMSI is deactivated; and

no more than one IMSI and MSISDN is active on the SIM at the same time.

#### BRIEF DESCRIPTION OF DRAWINGS:

- 25 An embodiment of the invention will now be described with reference to the appended drawings, in which:

Fig. 1 shows schematically how a vehicle such as a motor car is equipped with a SIM, and  
30

Fig. 2 shows schematically the manner in which data is updated on said SIM, in accordance with the present invention, so as to change the information in the SIM and change the operator to which it is associated.

5

#### PREFERRED EMBODIMENT:

An embodiment of the invention will now be described, by way of example.

In order to facilitate an understanding of the present invention, a glossary of the abbreviations used herein is set out below:

BC	-	Bearer Capability
BTS	-	Base Transceiver Station
GSM	-	Global System for Mobile communications
15 GW	-	Gateway
HLR	-	Home Location Register
IMSI	-	International Mobile Subscriber identification
LUP	-	Locating Update
MSISDN	-	Mobile Subscriber International ISDN number
20 MSC	-	Mobile services Switching Centre
OTA	-	Over The Air
SIM	-	Subscriber Identity Module (Smart Card)
SMSC	-	Short Message Service Center
VIN	-	Vehicle Identity Number
25 VLR	-	Visitor Location Register

The invention is a method of, and system for, changing the subscription information held on the SIM of a GSM mobile radio communication apparatus, for example a car phone (i.e. a mobile transceiver) or another type of mobile terminal. The invention is particularly, but not exclusively, suitable for use together with a mobile terminal which is intended to be permanently mounted in a car during final assembly of the car. When a car

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fitted with a GSM phone is manufactured in Sweden, say, the phone will have a SIM containing subscription details relating to a Swedish mobile phone operator, such as TELIA Mobile Sweden. However, the car may be sold in a territory controlled by another operator, e.g. Cellnet. If the  
5 subscription is not changed, the car phone will, for most of the time it is in use, operate in roaming mode. This places a heavy signalling load on the mobile networks in which the home location and visitor location registers are located.

10 The SIM, in a mobile phone, contains a subscriber identity code in the form of a so-called International Mobile Subscriber Identity (IMSI) and a secret key  $k_i$  (which is intended to be used for authentication during operation of the mobile terminal). Typically, a mobile telephone network will have a subscriber register for maintaining a register of subscriber identity codes and a message  
15 transmission system for the transmission of messages in the mobile telephone network. A record is created in the subscriber register when the first subscription for a subscriber is opened. This record comprises a call number specific to the subscription, an encryption code and a subscriber identity code associated with the subscription. In addition, services specified  
20 for the subscriber in the mobile communication network can be stored in a home location register. The home location register contains subscriber specific information relating to the right of use and functions of mobile telephones. When the subscriber enters the area of a mobile communication switching centre, the mobile station reports to its visitor location register  
25 (VLR). The mobile communication switching centre then fetches the subscriber data from the subscriber's home location register and sends them to the visitor location register of its own area and simultaneously updates the location data for the subscriber.

30 As stated above, large mobile communication networks comprise several home location registers. Furthermore, the range of subscriber identity codes (IMSI) for a single home location register can be divided into several



sections, which means that, in respect of control of subscriber identity modules, a single physical subscriber register device may comprise several subscribe registers (different IMSI) ranges).

- 5 Considering the case of Telia Mobile Sweden, the company distributes GSM mobile phones, with built in SIMs, to Swedish car manufacturers for installation in their cars. The eventual destination of the car is unknown and could, for example be the UK, France, or Germany. The built in SIM is, of course, loaded with a Swedish IMSI - the International Mobile Subscriber  
10 Identity, a code which identifies the mobile telephone to a mobile network. This IMSI is used for the first update of the SIM.

- After the SIM has been updated, Telia Mobile Sweden downloads a new IMSI number over the GSM air interface, i.e. OTA, together with a new  
15 MSISDN for an appropriate local operator in the territory, or country, where the car is located. If appropriate, the SIM can be updated a second, third, etc., time with new IMSI numbers and MSISDNs, again over the GSM air interface, if another operator is to be used.

- 20 It should be noted that, at the present time, most mobile phone operators work on a national basis and have roaming agreements with operators in other countries. The present invention provides, inter alia, a SIM which supports OTA and, thereby, facilitates downloading of new IMSI numbers and MSISDNs, thus supporting greater international connectivity.

- 25 The invention will now be described in greater detail with reference to the appended drawings, in which Fig. 1 shows how a vehicle 1 is equipped with a particular SIM 2 and Fig. 2 shows the manner in which subscription information being stored on the SIM is changed in accordance with the  
30 invention.

Fig. 1 indicates in a schematical manner that said vehicle 1 is equipped with a SIM 2 during final assembly of the vehicle 1. More precisely, the SIM 2 is normally arranged as a fixed component forming part of an electronic control unit 3 which is arranged in the vehicle 1 together with other vehicle components such as the chassis and body structure 4. The control unit 3 is used in the vehicle for controlling, for example, the injection timing and the fuel injection of the vehicle's 1 engine. The control unit 3 is also adapted for radio communication. To this end, it comprises a mobile radio communication terminal of the above-mentioned kind. In a manner which is known per se, said SIM 2 is used in such a mobile terminal.

After final assembly of the vehicle 1, it can be shipped to other countries, for example to Denmark (indicated by means of reference numeral 1a) or to Italy (indicated by means of reference numeral 1b). As mentioned initially, this situation gives rise to certain problems, in particular due to the fact that the final destination country for the vehicle 1 is normally not known at the time of final assembly.

The SIM 2 is "personalized", i.e. it is provided with a predetermined IMSI number (International Mobile Subscriber Identity). It is also provided with its secret authentication key  $k_i$  and its OTA key, which is another key used by the company issuing the SIM 2, during transmission between said company and the SIM 2.

The SIM 2 is supplied to the car manufacturer in question and is mounted in the corresponding car 1, i.e. in its control unit 3. The IMSI number and the corresponding vehicle identity number (VIN) are stored in a database of the company supplying the SIM. At this stage, the SIM 2 cannot yet be used.

Furthermore, when the car 1 is finally assembled and ready for delivery from the factory, its control unit 3 is mounted. However, the radio communication operation of the control unit 3 is not yet activated. At this stage, it can be

assumed that the final destination of the car, i.e. the country in which it is eventually sold, is not yet known. However, when the car 1 has finally reached its final destination, the company distributing or selling the car sends a request to the above-mentioned supplying company to carry out a change  
5 of the subscription information in the SIM. This is because it is now desired that the SIM 2 be associated with an appropriate "domestic" network operator, i.e. an operator which is located in its final destination country.

Fig. 2 indicates in greater detail how the information of the SIM 2 is shifted,  
10 so that the SIM and, as a result, the mobile terminal in the car 1 can be associated with a particular network operator in the final destination country. However, the invention is not limited for use in such a manner that the new network is located in another country. A principle behind the invention is that the SIM 2 is initially associated with a first, initial network operator and that  
15 the information in the SIM 2 can be shifted so as to be associated with an additional (second, third or further) network operator. It can be noted that the first, initial network operator is normally not intended to allow normal radio communication via the mobile terminal in question. The initial network is preferably a first temporary "operator" which is subsequently changed for a  
20 second operator when the vehicle has reached its final destination. In this regard, and for the purpose of describing the present invention, it is assumed that the car is assembled in Sweden and then shipped to Italy, in order to be sold in Italy.

25 The initial International Mobile Subscriber Identity (IMSI) code of the mobile terminal is referred to as "IMSI-A". This IMSI-A code is associated with a particular Mobile Station ISDN Number (MSISDN), which in this case is referred to as "MSISDN-A". This operation is carried out by the company which supplies the SIM and which is indicated by means of reference  
30 numeral 5 in Fig. 2. This company 5 is normally cooperating with different network operator in various countries. Each foreign operator will then accept and store (in their Home Location Registers) certain IMSI codes which can

be used when assigning the SIM 2 to a new operator in its final destination country.

When the mobile terminal in the car is to be used for the first time in its final destination country (in this case Italy), it will use its IMSI-A in order to issue a so-called Locating Update (LUP) from its position in Italy (reference numeral 6). This LUP is sent via a Base Transceiver Station (BTS) 7 to a Mobile services Switching Centre (MSC) 8 in Italy. The MSC 8 will indicate that no information regarding the SIM in question is registered in its Visitor Location Register (VLR). For this reason, the MSC will signal the IMSI-A to Sweden so as to indicate that said LUP has been made (reference numeral 9). This will be carried out via a second Mobile services Switching Centre (MSC) 10 in Italy. This MSC comprises a so-called Gateway (GW), which in this regard will operate as a transit or relay station. During this stage, the VLR address will also be signalled. The second MSC 10 will forward this message to a corresponding, third MSC 11 in Sweden. This third MSC 11 also comprises a Gateway, and is arranged for forwarding the message to the correct Home Location Register 12 in the country of origin (i.e. in this case Sweden) of the car 1, i.e. the HLR which is associated with the IMSI-A.

The HLR 12 with which the SIM is associated comprises information regarding the MSISDN-A code corresponding to the SIM in question, and also information regarding any occurring Bearer Capability (BC). This information is transmitted back to Italy, to the MSC 8 in which the above-mentioned Visitor Location Register is arranged (reference numeral 13). As a result, the MSC 8 in Italy updates its VLR with information regarding the identity of the Swedish Home Location Register 12 as well as information regarding the MSISDN-A and the BC. This will result in the MSC/VLR 8 transmitting a new Locating Update to the mobile terminal in the car 1 (reference numeral 14).

At this stage also, the company 5 supplying the SIM transmits data regarding a new IMSI number (referred to as "IMSI-B") intended for a local network operator in Italy (reference numeral 15). This message is preferably sent via a Short Message Service Center (SMSC) 16. As mentioned above, the HLR 5 18 in Italy has previously been supplied with the IMSI-B codes. It has also been supplied with MSISDN-B codes which are associated with said IMSI-B codes. These IMSI-B and MSISDN-B codes have consequently been reserved for the local network operator in Italy.

10 Furthermore, the company supplying the SIM transmits data instructing the mobile terminal in the vehicle 1 to shift the contents in the SIM from IMSI-A to IMSI-B and to reboot the mobile terminal (reference numeral 17).

After rebooting, the mobile terminal makes a new Locating Update (LUP). 15 This time, the LUP will be made using IMSI-B. The IMSI-B is associated with a HLR 18 located in Italy. This means that the HLR 18 in Italy sends back a LUP, including information related to the subscription and MSISDN-B to the VLR. More precisely, the HLR 18 will update the MSC/VLR 8 upon request from the MSC/VLR 8, which in turn will be initiated when the mobile terminal 20 sends its LUP. Consequently, the mobile terminal in the vehicle 1b is now updated with changed subscription information and is associated with a new network operator in Italy.

Consequently, according to the invention, subscription information held on 25 the SIM of a GSM phone, particularly a car phone, can be changed. When a car fitted with a GSM terminal is manufactured in for example Sweden, the terminal will have a SIM containing subscription details relating to a Swedish mobile phone operator. However, the car may be sold in a territory controlled by another operator. If the subscription is not changed, the car phone will, for 30 most of the time it is in use, operate in roaming mode. As has been explained, the present invention overcomes these problems by activating the SIM when the car reaches its final destination with an OTA signal. The SIM

will then be associated with an additional, local network in its final destination.

5 The invention is not limited to the embodiment described above, but may be varied within the scope of the appended claims. Although the present invention has been described with reference to a GSM mobile telephone system, it has application to digital cellular mobile telephone systems compliant with other standards. Equally, the use of the present invention is not limited to car phones, but can be applied to any mobile phone, having a  
10 built in SIM, which is distributed in a territory unknown at the time of manufacture, and/or for use with a network operator unknown at the time of manufacture.

## CLAIMS:

1. In a cellular digital mobile telephone system, including at least some mobile transceivers fitted with fixed SIMs having recorded thereon a first identity code and a first ISDN number relating to an initial mobile telephone operator, a method of updating said first identity code and said first ISDN number, characterized by delivering a second identity code relating to at least an additional mobile telephone operator over an air interface to said given SIM and connecting the second identity code to a second ISDN number at the same time as the first identity code is deactivated, such that no more than one identity code and ISDN number are active on said SIM at any given time.
2. A method, as claimed in claim 1, characterized by said cellular mobile telephone system being a GSM network.
3. A method, as claimed in claim 2, characterized by said first and second identity codes being IMSIs and by said first and second ISDNs being MSISDNs.
4. In a GSM cellular digital mobile telephone system, including at least some mobile transceivers fitted with fixed SIMs having recorded thereon a first IMSI and a first MSISDN relating to an initial mobile telephone operator, a method of updating said first IMSI code and said first MSISDN, characterized by delivering a second IMSI relating to at least an additional mobile telephone operator over an air interface to said given SIM and connecting the second IMSI to a second MSISDN at the same time as the first IMSI is deactivated, such that no more than one IMSI and MSISDN are active on said given SIM at any given time.
5. A method, as claimed in any previous claim,

characterized by said mobile transceivers being fitted in motor vehicles and said first IMSIs and MSISDNs being loaded on to said SIMs prior to installation of said mobile transceivers in said motor vehicle.

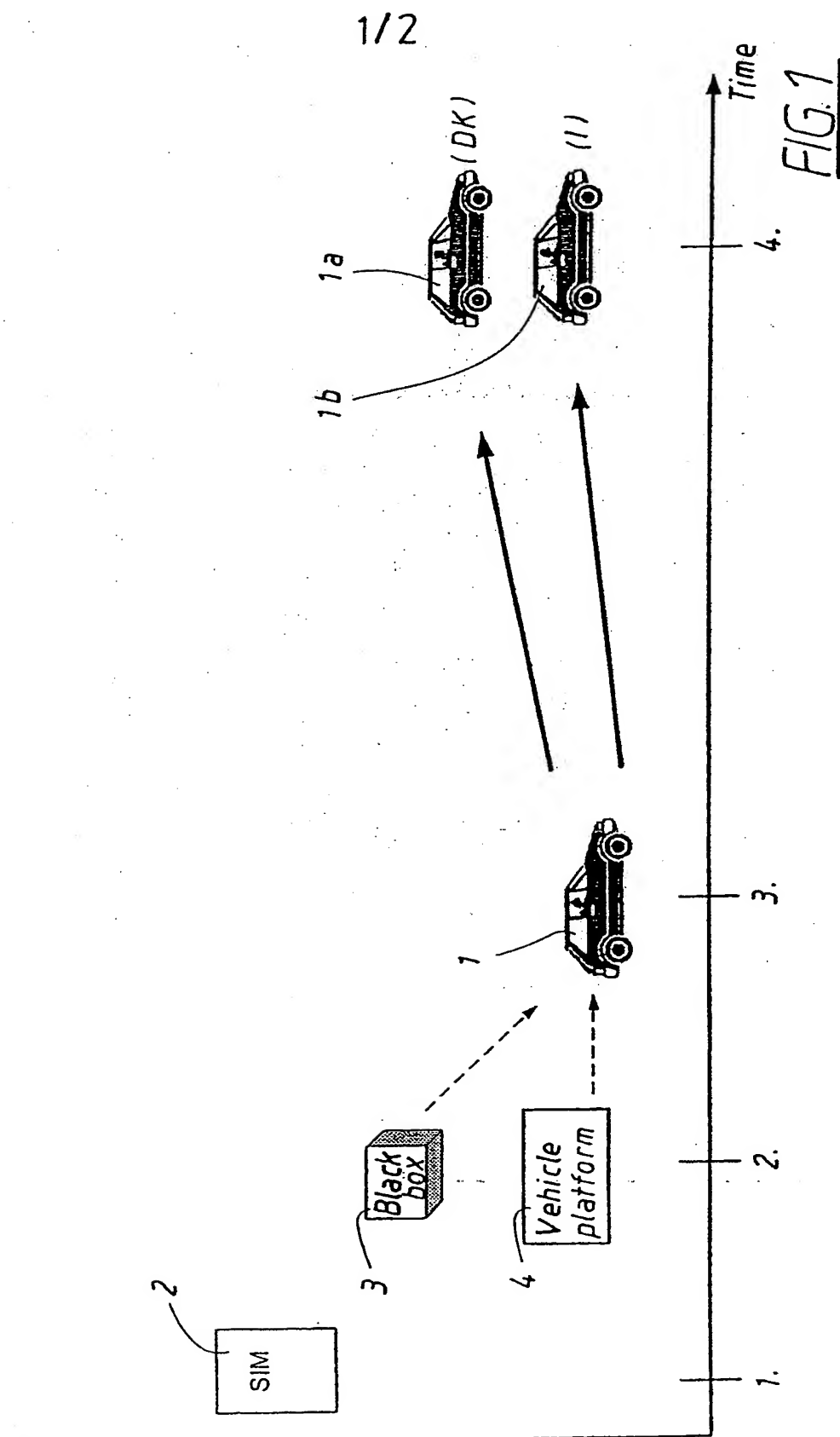
5 6. A method, as claimed in any previous claim,  
characterized by said initial and additional operators being located in  
different countries or different geographic regions.

7. A digital mobile cellular telephone system, characterized in  
10 that said digital mobile cellular telephone system is adapted to implement the  
method claimed in of claims 1 to 6.

8. A SIM for use in a mobile transceiver, characterized in that  
said SIM is adapted to implement the method as claimed in any of claims 1 to

15 6.





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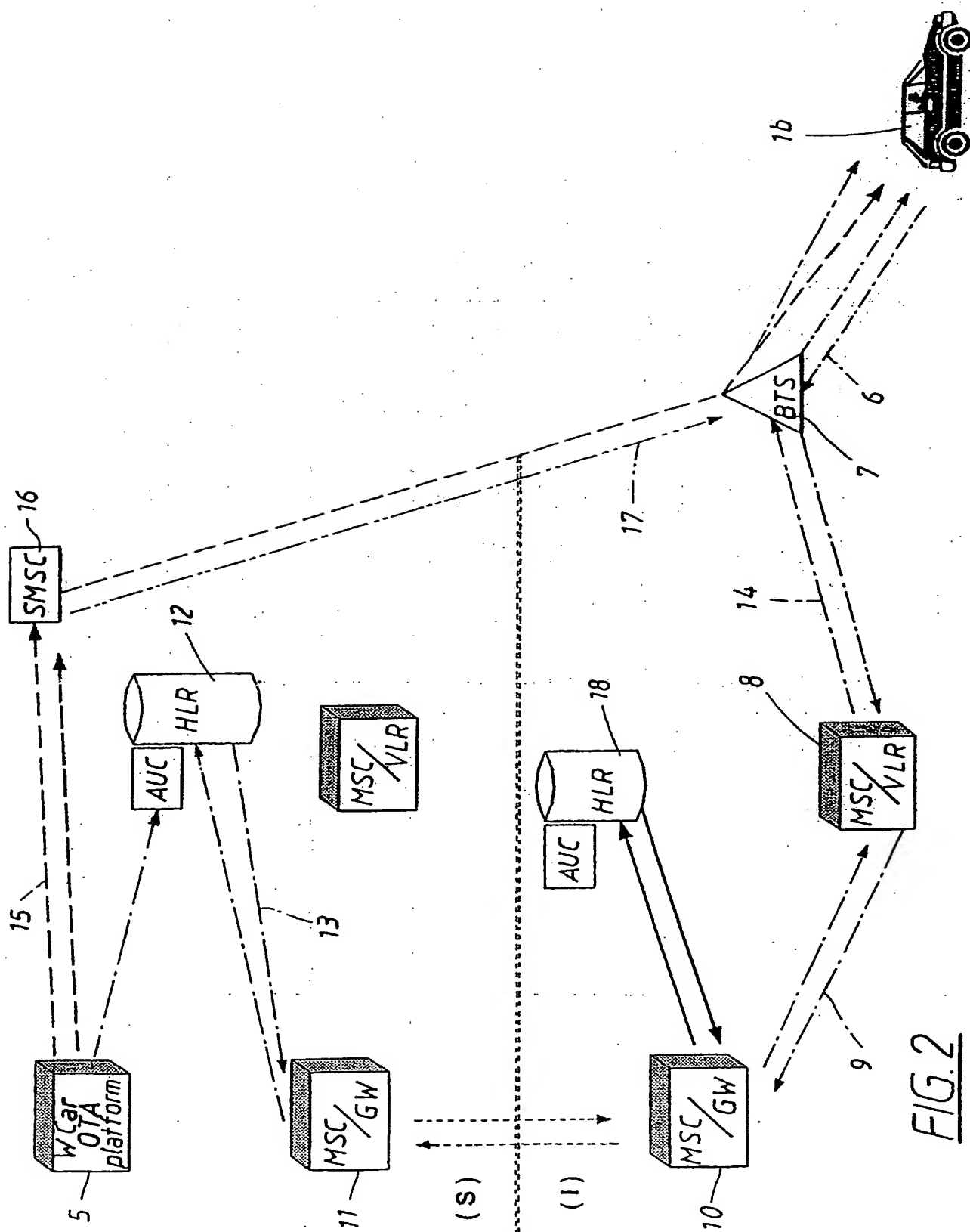


FIG. 2

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## INTERNATIONAL SEARCH REPORT

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## A. CLASSIFICATION OF SUBJECT MATTER

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SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 9856201 A2 (SONERA OY), 10 December 1998 (10.12.98), page 10, page 11, line 1-21, page 11, line 27-30, page 12, line 26 abstract	1-8
A	US 6014561 A (MÖLNE), 11 January 2000 (11.01.00), column 9, line 34 - column 12, line 26, abstract	1-8



Further documents are listed in the continuation of Box C.



See patent family annex.

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Authorized officer

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**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

02/07/01

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Patent document cited in search report			Publication date	Patent family member(s)		Publication date
WO	9856201	A2	10/12/98	AU	7657198 A	21/12/98
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